CHAPTER IV

RESULT AND DISCUSSION

4.1 Product Result

Nata de pinari is a new variant and innovation of nata de coco in the food industry that utilizes food waste as it is main ingredient. The nutrients contained in nata de pinari depend on the quantity of ingredients used during the production process, especially in the usage of its main ingredients, namely rice washing water, pineapple skin and pineapple flesh. This is because nata de pinari can also be produced with different ratios of main ingredients from the author's recipe. It has been proven by the author during the experimental production of nata de pinari, where several samples were created using ingredients such as rice washing water, pineapple skin, pineapple flesh, sugar and vinegar with different measurements, but resulting in nata de pinari with different textures, flavors and thicknesses.

In the production of nata de pinari, an aerobic fermentation process using *Acetobacter xylinum* bacteria is required. During the fermentation process, these nata-producing bacteria produce enzymes that can convert 19% of the glucose or sugar content into cellulose in the form of polysaccharide strands (Ramdani in Maryam, 2021). The sugar content in the substrate affects the formation of nata in terms of it is thickness and characteristics because sugar is a carbon source that will be synthesized by *Acetobacter xylinum* into cellulose and acid. According to (Margaretha in Maryam, 2021), the higher the sugar content used, the thicker the resulting nata. This occurs because *Acetobacter xylinum* converts the sugar content in the substrate into a carbon source that serves for bacterial growth and the production of cellulose or nata layers (Maryam, 2021). The fermentation process is the most crucial aspect to consider in the production of nata de pinari as it takes quite a long time, specifically 14 days, at the temperature of 28^{o}C – 30^{o}C and the nata de pinari must be free from vibrations or shocks during the fermentation process.

The main component of nata de pinari is cellulose. Cellulose or dietary fiber is beneficial for the human digestive system, including to assist in the peristaltic movement of the large intestine, which can help promote regular bowel movements. In one serving (200 g) of nata de pinari, the is 22 g of dietary fiber contained. Additionally, nata de pinari is a low-calorie food with a content of 120 calories per 1 serving (200 g), making it suitable for consumption by individuals who are on a diet.

From the results of the sensory test that was conducted, 10 out of 10 panelists approved the overall outcome of nata de pinari. However, there were 2 panelists who did not approve of the texture of nata de pinari and 1 panelist who did not approve of it is sight, as according to the panelist, the shape of the nata de pinari need to be improved in terms of it is neatness. Besides that, nata de pinari also received positive feedback from several panelists, They expressed that nata de pinari is well-made, starting from it is texture, which is not hard and is in accor dance with nata de coco that sold commercially, as well as the taste of nata de pinari that is well-balanced, not overly sweet, nor too bland.

4.2 Nutrition Fact

4.2.1 Nutrition Table

The nutritional content of rice washing water is as follows:

Table 4.1 Nutrition content of rice washing water per 100 ml

Nutrition	Total/100 ml
Nitrogen (%/100 ml)	0,015
Phosphorus (%/100 ml)	16,306
Potassium (%/100 ml)	0,02
Calcium (%/100 ml)	2,944
Magnesium (%/100 ml)	14,252
Sulfur (%/100 ml)	0,027
Iron (%/100ml)	0,0427

Vitamin B1 (%/100 ml)	0,043
Carbohydrate (g/100 ml)	1,6
Sugar (g/100 ml)	1,52
Sodium (mg/100 ml)	13

(Citra Wulandari *et al*., in Zaura et al., 2023 ; *Rice Water Calories, Carbs & Nutrition Facts*, 2023)

Table 4.2 Nutrition content of pineapple skin per 100 g

Nutrition	Total/100 g
Carbohydrate (g/100 g)	2,9
Sugar (g/100 g)	2,2
Protein (g/100 g)	0,11
Sodium (mg/100 g)	0,22
Potassium (mg/100 g)	24,22
Vitamin A (%/100 g)	0,22
Vitamin C (%/100 g)	17,5
Calcium (%/100 g)	0,22
Iron (%/100 g)	0,22
Crude fiber (%/100 g)	19,49
Crude fat (%/100 g)	1,88
Ash (%/100 g)	4,52

(*Pineapple Skin Calories, Carbs & Nutrition Facts,* 2023 ; Ramadhan & Syarif in Noviandi et al., 2018)

Table 4.3 Nutrition content of pineapple flesh per 100 g

Nutrition	Total/100 g
Energy (kcal/100 g)	40
Total fat (g/100 g)	0,30
Vitamin B1 (mg/100 g)	0,02
Vitamin B2 (mg/100 g)	0,04

Vitamin B3 (mg/100 g)	0,20
Vitamin C (mg/100 g)	22
Total carbohydrates (g/100 g)	9,90
Protein (g/100 g)	0,60
Dietary fiber (g/100 g)	0,60
Calcium (mg/ 100 g)	22
Phosphorus (mg/100 g)	14
Sodium (mg/100 g)	18
Potassium (mg/100 g)	111
Iron (mg/100 g)	0,90
Zinc (mg/100 g)	0,10
Beta-Carotene (mcg/100 g)	17
Water (g/100 g)	88,90
Ash (g/100 g)	0,30

(Risqi, 2018)

Table 4.4 Nutrition content of nata de pinari syrup per 100 ml

Nutrition	Total/100 ml
Energy (kcal/100 ml)	78,8
Total carbohydrates (g/100 ml)	18,8
Calcium (mg/100 ml)	1
Phosphorus (mg/100 ml)	0,2
Sodium (mg/100 ml)	0,2
Potassium (mg/100 ml)	0,95
Iron (mg/100 ml)	0,02
Water (g/100 ml)	101,08
Ash (g/100 ml)	0,12

(Risqi, 2018)

4.2.2 Nutrition Calculation

Table 4.5 Nutrition content of ingredients used in the recipe for nata de pinari

Ingredients	Energy (kcal)	Nitrogen (%)	Phosphorus (mg)	Potassium (mg)	Calcium (mg)	Magnesium (mg)	Sulfur (mg)	Iron (mg)	Vitamin A (%)	Vitamin B1 (mg)	Vitamin B2 (mg)	Vitamin B3 (mg)	Vitamin C (mg)	Carbohydrate (g)	Fiber (g)	Sugar (g)	Fat (g)	Protein (g)	Sodium (mg)	Zinc (mg)	Beta-Carotene (mcg)	Water (g)	Ash (g)
Rice Washing Water (1000 ml)		0,15	163,06	0,2	29,44	142,52	0,27	0,427		0,43				16		15,2			130				
Pineapple skin (450 g)				108,99	0,99			0,99	0,99				78,75	13,05	87,705	9,9	8,46	0,495	0,99				20,34
Pineapple flesh (50 g)	20		7	55,5	11			0,45		0,01	0,02	0,10	11	4,95	0,30		0,15	0,30	9	0,05	8,5	44,45	0,15
White vinegar (10 ml)	2,1		1	3,78	0,7			0,05		0,024		0,07		0,5			0,01	0,01	2,1			9,45	0,03
Nata de pinari syrup (600 ml)	472,8		1,2	5,7	6			0,12						112,8					1,2			606,48	0,72
Total (per recipe)	494,9	0,15	172,26	174,17	48,13	142,52	0,27	2,037	0,99	0,464	0,02	0,17	89,75	147,3	88,005	25,1	8,62	0,805	143,29	0,05	8,5	660,38	21,24
Total (per package)	247,45	0,075	86,13	87,085	24,065	71,26	0,135	1,0185	0,495	0,232	0,01	0,085	44,875	73,65	44,0025	12,55	4,31	0,4025	71,645	0,025	4,25	330,19	10,62

4.2.3 Nutrition Label

Nutrition Facts

2 servings per container

Serving size **1/2 Jar (200g)**

Amount Per Serving

Calories **120**

	% Daily Value*
Total Fat 2g	**3%**
Saturated Fat 0g	**0%**
Trans Fat 0g	
Cholesterol 0mg	**0%**
Sodium 35mg	**2%**
Total Carbohydrate 37g	**13%**
Dietary Fiber 22g	**79%**
Total Sugars 6g	
Includes 0g Added Sugars	**0%**
Protein 0g	**0%**
Vitamin D 0mcg	0%
Calcium 12.03mg	0%
Iron 0.5092mg	2%
Potassium 43.54mg	0%

*The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

Figure 4.1 Nutrition fact of Nata de Pinari

4.3 Food Safety and Packaging

4.3.1 Processing and Storage Temperature

Nata de pinari is a fermented food product that utilizes a substrate made from rice washing water, pineapple skin and pineapple flesh, which is fermented using *Acetobacter xylinum* bacteria. There are several processes involved in the production of nata de pinari, including sterilization through boiling techniques, sterilization of utensils with 70% alcohol and fermentation.

Sterilization through boiling at a temperature of 121ºC is the optimal temperature for destroying microbes and spores (Maherawati et al., 2022). Boiling in the nata de pinari production process is mandatory to maintain product quality and food safety because the main ingredient of this product is food waste. Furthermore, since the use of pineapple skin is known to potentially cause itching when consumed, the nata de pinari substrate must be boiled to prevent itching when the product is consumed. In addition, boiling serves to sterilize the substrate, which is

the growth medium for *Acetobacter xylinum* bacteria, ensuring these bacteria to grow and develop without contamination. If *Acetobacter xylinum* bacteria are inoculated into a non-sterile substrate, the bacteria can die and fail to produce cellulose, resulting in a failure in nata de pinari production.

The next process is sterilizing the utensils using 70% alcohol. This stage aims to prevent the *Acetobacter xylinum* bacteria from being contaminated. The use of 70% alcohol can kill 99.05% of bacteria, prevent the growth of several types of bacteria, and it has been proven that using 70% alcohol for sterilization is more effective at killing bacteria compared to UV exposure (Elisanti et al., 2020).

And the last step is the fermentation process, which lasts for 14 days, at the temperature of 28°C - 30°C and must be placed in a place that free from vibrations and shocks to produce thick cellulose with a smooth surface, chewy and soft texture.

4.3.2 Shelf Life

The shelf life of food products is the time period from production to consumption, and the condition in terms of appearance, taste, aroma, texture, and nutritional value of the food product should still be good, with its quality maintained (Domili, 2021). Several efforts to extend the shelf life include sterilizing nata de pinari through boiling techniques until it reaches a temperature of 121°C, soaking the product in a liquid containing 20% sugar, which can serve as a preservative, and providing storage recommendations such as storing the product in a refrigerator.

The author conducted observations on Nata de Pinari products stored in two different conditions: at room temperature and inside a refrigerator at around 4°C. The results of the observation for the shelf life of Nata de Pinari products containing *Zwavelzure Ammoniak*, without any preservatives, soaked in pandan syrup and packaged in food-grade PET plastic jar, are as follows: 1 month when stored in the refrigerator at

around 4°C and 2 days when stored at room temperature with the packaging sealed. On the third day, the author noticed that the packaging lid began to condense moisture and emit a slight unpleasant odor. This represents a significant difference in shelf life when compared to Nata de Coco products without *Zwavelzure Ammoniak* and preservatives, as they can last twice as long as Nata de Pinari products. Nata de Coco products without *Zwavelzure Ammoniak* and preservatives can last for 2 months at 5°C, 23 days at 15°C, 9 days at 25°C and 7 days at room temperature (28°C) (Gp et al., 2018).

4.3.3 Product Packaging

Product packaging is defined as the wrapper or container of a product designed to support the product during marketing (Samodro et al., 2022). Food products must have packaging that is safe, informative, and attractive. This packaging serves as a marketing and branding medium, which can help build a product's brand image with consumers, thereby enhancing the value of the food product when it is sold. In addition, packaging for food products serves several functions, including extending the shelf life of the product, preserving and maintaining the quality of the food product, acting as a means of branding, and aiding in the distribution of food products from the manufacturer to the consumer. This ensures that the food product is received in a safe condition with guaranteed quality (Julianti in Setiyoko et al., 2022).

Additionally, Nata de Pinari products also use labels on the packaging to enhance their attractiveness and provide information. Packaging labels are defined as components of a product's packaging that contain verbal information about the product and the seller or manufacturer of the product (Herydiansyah et al., in Novianti et al., 2022). These labels typically include information about the product, such as its name, composition, serving suggestions, nutritional content, production date, and expiration date. Packaging labels can instill trust in

consumers and entice them to purchase and consume a food product (M. Prawiro in Novianti et al., 2022). Packaging and labels act as safeguards for food products, offering product information and serving as promotional tools that can capture consumers' interest and boost food product sales.

Nata de Pinari is packaged in 500 ml PET (Polyethylene Terephthalate) Food-Grade plastic jars. PET plastic packaging is a recyclable material. It is widely recognized and extensively used in the food and beverage industry in Indonesia for its strength, hygiene (as it is single-use packaging), attractive transparency, and affordability. The advantages of PET plastic packaging include its durability and resistance to temperatures ranging from 60°C to 85°C, as well as its resistance to acidic, alkaline, alcoholic, oily solutions, and gases. This makes it effective in preventing changes in aroma and other forms of contamination in products while maintaining an attractive transparent appearance (Fitriyano, 2019).

Figure 4.2 Food-Grade PET Plastic Jar 500ml

Figure 4.3 Logo

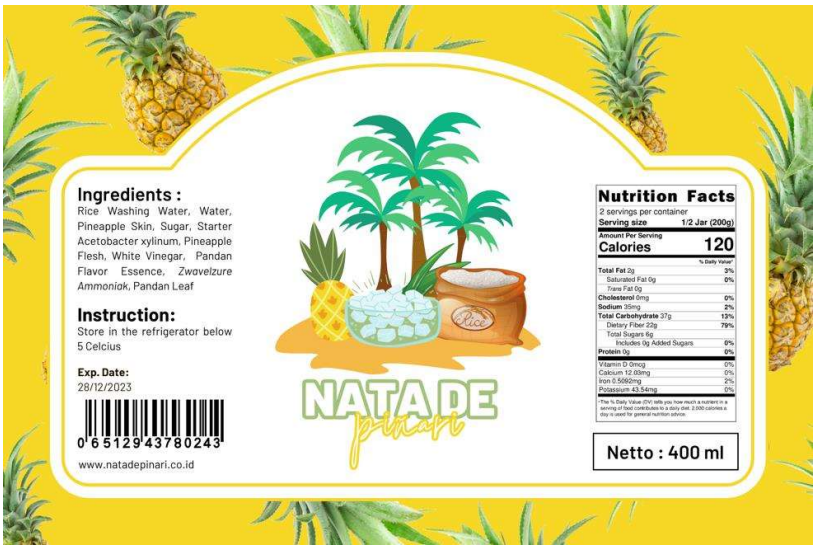

Figure 4.4 Label

4.4 Financial Aspects

4.4.1 Product Cost (Variable Cost, Overhead Cost, Fixed Cost)

Nata de pinari's product cost is calculated based on the total of all cost per month. The costs consist of labour cost, raw material cost, packaging cost and utility cost. The labour cost for the production of nata de pinari will be based on the working days per month, with a total of 25 working days per month. The raw materials for producing nata de pinari

will be calculated as 25 recipes per day and 625 recipes per month, which is equivalent to 50 containers of nata de pinari per day and 1.250 containers of nata de pinari per month.

1. Start-up Capital

Table 4.6 Start-up Capital

Tools and Equipment	Quantity	Price (/Unit)	Sub Total
Digital scale	2	Rp 70.000	Rp 140.000
Cutting board	2	Rp 53.000	Rp 106.000
Knife	2	Rp 26.000	Rp 52.000
Large bowl	6	Rp 50.000	Rp 300.000
Blender	2	Rp 620.000	Rp 1.240.000
Cloth filter	2	Rp 14.000	Rp 28.000
Sauce pan	4	Rp 195.000	Rp 780.000
Silicon spatula	4	Rp 20.000	Rp 80.000
Square food container	25	Rp 5.000	Rp 125.000
Measuring cup	4	Rp 13.500	Rp 54.000
Digital pH meter	2	Rp 45.000	Rp 90.000
Baking paper (per 10 meter)	21	Rp 13.000	Rp 273.000
Rubber band (per 100 pcs)	6	Rp 3.000	Rp 18.000
Stove	1	Rp 400.000	Rp 400.000
Refrigerator	1	Rp 2.555.000	Rp 2.555.000
TOTAL			**Rp 6.241.000**

2. Labour Cost

Table 4.7 Labour Cost

Occupation	Personnel	Salary (/Month)	Sub Total
Food production employee	2	Rp 2.000.000	Rp 4.000.000
TOTAL			**Rp 4.000.000**

3. Packaging Cost

Table 4.8 Packaging Cost

Packaging	Quantity	Price (/Unit)	Sub Total
PET food grade plastic jar	50 pcs	Rp 3.500	Rp 175.000
Waterproof packaging sticker	5 sheets	Rp 10.000 (/10 pcs)	Rp 50.000
Waterproof logo sticker	4 sheets	Rp 10.000 (/13 pcs)	Rp 40.000
Plastic bag	1 pack	Rp 4.000 (/50 pcs)	Rp 4.000
TOTAL (/Day)			**Rp 269.000**
TOTAL (/Month)			**Rp 6.725.000**

4. Utility Cost

Table 4.9 Utility Cost

Facility	Quantity	Price (/Unit)	Sub Total
Electricity	150 kWh	Rp 1.500/kWh	Rp 225.000
Water	5.00 M3	Rp 12.500	Rp 62.500
Gas	5,5 kg	Rp 96.000	Rp 96.000
TOTAL (/Day)			**Rp 15.340**
TOTAL (/Month)			**Rp 383.500**

5. Raw Material Cost

Table 4.10 Raw Material Cost

Raw Materials	Quantity	Price (/Unit)	Sub Total
Rice washing water	1000 ml x 25	Rp 0 (/1000 ml)	Rp 0
Pineapple skin & pineapple flesh	500 g x 25	Rp 0 (/1000 g)	Rp 0
Table sugar	210 g x 25	Rp 14.000 (/1000 g)	Rp 73.500
White vinegar	10 ml x 25	Rp 9.500 (/650 ml)	Rp 3.700
Starter (*Acetobacter xylinum)*	100 ml x 25	Rp 65.000 (/450 ml)	Rp 361.000

Food grade ZA (*Zwavelzure Ammoniak*)	8 g x 25	Rp 35.000 (/1000 g)	Rp 7.000
70% rubbing alcohol	10 ml x 25	Rp 28.000 (/1000 ml)	Rp 7.000
Mineral water	600 ml x 25	Rp 18.000 (/19 L)	Rp 14.210
Pandan leaf	10 leaves x 25	Rp 10.000 (/50 leaves)	Rp 50.000
Pandan flavor essence	10 ml x 25	Rp 10.500 (/30 ml)	Rp 87.500
TOTAL (/Day)			**Rp 603.910**
TOTAL (/Month)			**Rp 15.097.750**

6. Rent Cost

Table 4.11 Rent Cost

Facility	Size	Price	Sub Total
Maintenance cost		Rp 500.000 (/Month)	Rp 500.000
TOTAL (/Month)			**Rp 500.000**

7. Total Cost

Fixed Cost = Labour Cost and Rent Cost

Variable Cost = Raw Material Cost, Packaging Cost and Utility Cost

Total Cost (/Month) = Labour + Raw Material + Packaging + Utility + Rent Cost

= Rp 4.000.000 + Rp 15.097.750 + Rp 6.725.000 + Rp 383.500 + Rp 500.000

= Rp 26.706.250

4.4.2 Selling Price

Product Price $= \frac{Total\ Cost\ (/month)}{Total\ Product\ Units\ (/month)}$

$= \frac{\text{Rp } 26.706.250}{1{,}250 \text{ containers}}$

= **Rp 21.365 / container**

Product Selling Price = Product Price + $\left(\frac{Product\ Price\ x}{Profit\ Percentage}\right)$

= Rp 21.365 + (Rp 21.365 x 40%)

= Rp 21.365 + Rp 8.546

= Rp 29.911 ≈ Rp 30.000